

CLAIMS

1. Polymer/liquid crystal composite material with a holographic grating structure formed by an alternating ordered succession of polymer layers and layers of nematic liquid crystal, characterised in that the said nematic liquid crystal layers comprise a homogeneous nematic monophase region which is substantially free from droplets of liquid crystal.

2. Composite material according to claim 1, characterised in that is obtainable through the operations of:

- exposing a mixture comprising photoinitiator, monomer and nematic liquid crystal to an external agent selected from a temperature change and electromagnetic radiation capable of causing reversible loss of the crystalline order of the mesogenic component of the mixture,
- illuminating the composition through a radiation interference pattern capable of causing polymerisation of the illuminated regions,
- allowing the mesogenic material in the composition to reestablish the crystalline order through a slow decrease in the influence of the external agent.

3. Composite material according to claims 1 or 2, characterised in that it comprises the operations of:

- heating the said photoinitiator, monomer and nematic liquid crystal composition to a temperature above the nematic/isotropic phase transition temperature,
- illuminating the composition through a UV, visible or IR radiation interference pattern capable of causing polymerisation of the monomer,

- slow cooling of the composition below the isotropic/nematic transition point at the end of the polymerisation (curing) process in the absence of curing radiation.

4. Process according to claim 3, in which the said slow cooling of the composition is effected through thermal stabilisation of the composition.

5. Composite material according to claims 3 or 4, in which the said slow cooling is effected at a rate of cooling of between 0.1 and 0.3°C/minute.

6. Composite material according to any of the preceding claims, in which the layers of nematic liquid crystal contain colouring molecules or particles of nanometric dimensions or other doping agents.

7. Composite material according to any of the preceding claims, in which the polymer materials contain photosensitive or conducting or magnetic doping agents or fragments of polymer chains.

8.. Composite material according to any of the preceding claims, in which the mesogenic component of the mixture contains doping agents capable of causing a reversible isothermic transition within the nematic isotropic phase under the influence of the curing radiation or other radiation.

9. Process for the preparation of a holographic grating formed by an alternating ordered succession of polymer

layers and nematic liquid crystal layers, characterised in that it comprises the operations of:

- exposing a mixture comprising photoinitiator, monomer and nematic liquid crystal to an external agent, selected from a temperature change and electromagnetic radiation capable of causing reversible loss of the crystalline order of the mesogenic component of the mixture,
- illuminating the composition with an interference pattern of radiation capable of causing polymerisation of the illuminated regions,
- allowing the mesogenic material in the composition to reestablish the crystalline order through a slow decrease in the influence of the external agent.

10. Process according to claim 9, characterised in that it comprises the operations of:

- heating the said photoinitiator, monomer and nematic liquid crystal composition to a temperature above the nematic/isotropic phase transition temperature,
- illuminating the composition with an interference pattern of UV, visible or IR radiation capable of causing polymerisation of the monomer,
- slow cooling of the composition below the isotropic/nematic transition point at the end of the polymerisation (curing) process in the absence of curing radiation.

11. Electro-optical device comprising a composite material with a holographic grating structure according to any of claims 1 to 8.

12. Electro-optical device according to claim 11, comprising a switchable beam diffractor, a wavelength filter or a beam splitter.